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**(54) Title of the Invention ANTENNA FOR MOBILE COMMUNICATION UNIT**

**(57) Abstract**

**PROBLEM TO BE SOLVED:** To provide a small antenna for a mobile communication unit which can be fabricated on a printed board.

**SOLUTION:** Through holes 11-16 are made alternately in parallel on a printed board 10 constituting a radio section and the end parts of these through holes are connected to form a spiral as a whole thus constituting a helical antenna suitable for a mobile communication unit.

**Claims**

[Claim 1] Inside of the 1st virtual straight line which drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in said substrate so that said table reverse side double-sided substrates may be penetrated on said 1st virtual straight line 2nd at least three penetration through holes are formed in said double-sided substrate so that it may face alternately [ said 1st penetration through hole ] on said 2nd virtual straight line and said table reverse side double-sided substrate may be penetrated. Inside of said 1st at least three penetration through holes, Among said surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate, one opening side among said surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 1st straight line-like metal -- a line -- Furthermore To the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate Among said surface side substrate in the 1st penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on said 1st virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, a opening side of another side Wiring connection is made at the body. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd straight line-like metal -- a line -- Furthermore To a center-section side of said table reverse side double-sided substrate To the 1st

[ said ] located penetration through hole Among said surface side substrate in the 2nd penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on said 2nd virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, one opening side Wiring connection is made at the body. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 3rd straight line-like metal -- a line -- Furthermore To a center-section side of said table reverse side double-sided substrate A surface side substrate in the 2nd [ said ] located penetration through hole Among penetration through holes formed among rear-face side substrates a opening side of another side, and on [ at least three ] said 1st virtual straight line, among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or a opening side of a substrate of another side Wiring connection is made at the body. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 4th straight line-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] said 1st virtual straight line, Said surface side substrate in the 2nd penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] said 2nd virtual straight line among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 5th straight line-like metal -- a line -- by making wiring connection on the body On said 1st virtual straight line Connect to said surface side substrate and a rear-face substrate the 2nd penetration through hole formed in said at least three substrates on the 1st penetration through hole formed in said at least three substrates which can be set, and said 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. An antenna for mobile transmitters characterized by constituting.

[Claim 2] Inside of the 1st virtual straight line which drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in said substrate so that said table reverse side double-sided substrates may be penetrated on said 1st virtual straight line 2nd at least three penetration through holes are formed in said double-sided substrate so that it may face alternately [ said 1st penetration through hole ] on said 2nd virtual straight line and said table reverse side double-sided substrate may be penetrated. Inside of said 1st at least three penetration through holes, Among said surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate, one opening side among said surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 1st straight line-like metal -- a line -- Furthermore To the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate Among said surface side substrate in the 1st penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on said 1st virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, a opening side of another side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 1st loop-like metal -- a line -- Furthermore To a center-section side of said table reverse side double-sided substrate To the 1st [ said ] located penetration through hole Among said surface side substrate in the 2nd penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on said 2nd virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, one opening side Wiring connection is made with the body. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 2nd straight line-like metal -- a line -- Furthermore To a center-section side of said table reverse side double-sided substrate A surface side

substrate in the 2nd [ said ] located penetration through hole Among penetration through holes formed among rear-face side substrates a opening side of another side, and on [ at least three ] said 1st virtual straight line, among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or a opening side of a substrate of another side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] said 1st virtual straight line, Said surface side substrate in the 2nd penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] said 2nd virtual straight line among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 3rd straight line-like metal -- a line -- by making wiring connection with the body On said 1st virtual straight line Connect to said surface side substrate and a rear-face substrate the 2nd penetration through hole formed in said at least three substrates on the 1st penetration through hole formed in said at least three substrates which can be set, and said 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. An antenna for mobile transmitters characterized by constituting.

[Claim 3] said 1st loop-like metal -- a line -- the body and said 2nd loop-like metal -- a line -- an antenna for mobile transmitters according to claim 2-characterized by arranging a ferrite object between substrates of another side among the body, a surface side substrate, and a rear-face side substrate.

[Claim 4] An antenna for mobile transmitters according to claim 3 characterized by laying said ferrite object under the substrate of another side among a surface side substrate and a rear-face side substrate.

[Claim 5] Inside of the 1st virtual straight line which drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in said substrate so that said table reverse side double-sided substrates may be penetrated on said 1st virtual straight line 2nd at least three penetration through holes are formed in said double-sided substrate so that it may face alternately [ said 1st penetration through hole ] on said 2nd virtual straight line and said table reverse side double-sided substrate may be penetrated. Inside of said 1st at least three penetration through holes, Among said surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate, one opening side among said surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 1st loop-like metal -- a line -- Furthermore To the 2nd penetration through hole by the side of the 1 side edge section of said table reverse side double-sided substrate Among said surface side substrate in the 1st penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on said 1st virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, a opening side of another side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore To a center-section side of said table reverse side double-sided substrate To the 1st [ said ] located penetration through hole Among said surface side substrate in the 2nd penetration through hole located in a center-section side of said table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on said 2nd virtual straight line among said surface side substrate which can be set, or a rear-face side substrate, or a rear-face side substrate, one opening side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- one substrate top -- the 3rd loop-like metal -- a line -- Furthermore To a center-section side of said table

reverse side double-sided substrate A surface side substrate in the 2nd [ said ] located penetration through hole Among penetration through holes formed among rear-face side substrates a opening side of another side, and on [ at least three ] said 1st virtual straight line, among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or a opening side of a substrate of another side Wiring connection is made with the body in Yamagata. inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 4th loop-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] said 1st virtual straight line, Said surface side substrate in the 2nd penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] said 2nd virtual straight line among said surface side substrate in the 1st penetration through hole by the side of the other side edge section of said table reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of said surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 5th loop-like metal -- a line -- by making wiring connection with the body in Yamagata On said 1st virtual straight line Connect to said surface side substrate and a rear-face substrate the 2nd penetration through hole formed in said at least three substrates on the 1st penetration through hole formed in said at least three substrates which can be set, and said 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. An antenna for mobile transmitters characterized by constituting.

[Claim 6] said 1st loop-like metal -- a line, while arranging the 1st ferrite object between substrates of another side among the body, said 3rd loop-like metal-like object, a surface side substrate, and a rear-face side substrate said 2nd loop-like metal -- a line -- an antenna for mobile transmitters according to claim 5 characterized by arranging and constituting the 2nd ferrite object between one substrates among the body, said 4th loop-like metal-like object, a surface side substrate, and a rear-face side substrate.

[Claim 7] An antenna for mobile transmitters according to claim 6 characterized by laying underground and constituting said 2nd ferrite object in one substrate among a surface side substrate and a rear-face side substrate while laying said 1st ferrite object under the substrate of another side among a surface side substrate and a rear-face side substrate.

#### **[Detailed Description of the Invention]**

##### **[0001]**

[The technical field to which invention belongs] This invention relates to antennas for mobile transmitters which used the electric wave of UHF (Ultra High Frequency) and a microwave band, such as a cellular phone and PHS.

##### **[0002]**

[Description of the Prior Art] As shown in drawing 13, as for antennas for mobile transmitters, such as the conventional cellular phone, the helical antenna 1 around which the metal wire was coiled spirally is used. Compared with a straight line-like dipole antenna, the helical antenna 1 shown here is short, and can make a size small.

##### **[0003]**

[Problem(s) to be Solved by the Invention] However, when using it for mobile transmitters, the device for holding an antenna is required for the conventional helical antenna 1, and it had become the hindrance of miniaturizations, such as a cellular phone. Moreover, a possibility that variation might arise was also in the antenna property.

[0004] This invention was made in view of the point which the former requires, and proposes the antenna for mobile transmitters which can attain the simplification of an antenna maintenance device, and reduction of the variation in an antenna property.

##### **[0005]**

[Means for Solving the Problem] Inside of the 1st virtual straight line which this invention drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in a substrate so that front reverse side double-sided substrates may be penetrated on the 1st virtual straight line 2nd at least three penetration through holes are formed in a double-sided substrate so that it may face

alternately [ the 1st penetration through hole ] on the 2nd virtual straight line and a front reverse side double-sided substrate may be penetrated. Inside of 1st at least three penetration through holes, Among a surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate, one opening side among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 1st straight line-like metal -- a line -- Furthermore A surface side substrate in the 1st penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate Wiring connection is made at the body. or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd straight line-like metal -- a line -- Furthermore To a center-section side of a front reverse side double-sided substrate A surface side substrate in the 1st located penetration through hole Among a surface side substrate in the 2nd penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on the 2nd virtual straight line among rear-face side substrates, or a rear-face side substrate, or one opening side Wiring connection is made at the body. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 3rd straight line-like metal -- a line -- Furthermore A surface side substrate [ in / among penetration through holes formed a opening side of another side, and on / at least three / the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole located in a center-section side of a front reverse side double-sided substrate, or a rear-face side substrate / the 1st penetration through hole by the side of the other side edge section of a table reverse side double-sided substrate ] Wiring connection is made at the body. or inside of a rear-face side substrate -- a opening side of a substrate of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 4th straight line-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] the 1st virtual straight line, A surface side substrate in the 2nd penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] the 2nd virtual straight line among a surface side substrate in the 1st penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 5th straight line-like metal -- a line -- by making wiring connection on the body Connect to a surface side substrate and a rear-face substrate the 2nd penetration through hole formed in at least three substrates on the 1st penetration through hole formed in at least three substrates on the 1st virtual straight line, and the 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. It constitutes.

[0006] According to this invention, a helical antenna can be formed on a printed circuit board for mobile transmitters, and a miniaturization can be attained. Moreover, a device in which it is special to a transmitter for antenna maintenance is also unnecessary.

[0007] Moreover, inside of the 1st virtual straight line which drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in a substrate so that front reverse side double-sided substrates may be penetrated on the 1st virtual straight line 2nd at least three penetration through holes are formed in a double-sided substrate so that it may face alternately [ the 1st penetration through hole ] on the 2nd virtual straight line and a front reverse side double-sided substrate may be penetrated. Inside of 1st at least three penetration through holes, Among a surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate, one opening side among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection

is made with the body. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 1st straight line-like metal -- a line -- Furthermore A surface side substrate in the 1st penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate Wiring connection is made with the body in Yamagata. or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 1st loop-like metal -- a line -- Furthermore To a center-section side of a front reverse side double-sided substrate A surface side substrate in the 1st located penetration through hole Among a surface side substrate in the 2nd penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on the 2nd virtual straight line among rear-face side substrates, or a rear-face side substrate, or one opening side Wiring connection is made with the body. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 2nd straight line-like metal -- a line -- Furthermore A surface side substrate [ in / among penetration through holes formed a opening side of another side, and on / at least three / the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole located in a center-section side of a front reverse side double-sided substrate, or a rear-face side substrate / the 1st penetration through hole by the side of the other side edge section of a table reverse side double-sided substrate ] Wiring connection is made with the body in Yamagata. or inside of a rear-face side substrate -- a opening side of a substrate of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] the 1st virtual straight line, A surface side substrate in the 2nd penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] the 2nd virtual straight line among a surface side substrate in the 1st penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 3rd straight line-like metal -- a line -- by making wiring connection with the body Connect to a surface side substrate and a rear-face substrate the 2nd penetration through hole formed in at least three substrates on the 1st penetration through hole formed in at least three substrates on the 1st virtual straight line, and the 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. It constitutes.

[0008] According to this invention, the shape of a spiral can carry out helical antenna formation on a printed circuit board for mobile transmitters, and a miniaturization of equipment can be attained.

[0009] this invention -- the 1st loop-like metal -- a line -- the body and the 2nd loop-like metal -- a line -- a ferrite object is arranged between substrates of another side among the body, a surface side substrate, and a rear-face side substrate.

[0010] According to this invention, since a ferrite object was arranged in a helical antenna, the ferrite effect can attain the further miniaturization of a helical antenna.

[0011] This invention lays a ferrite object under the substrate of another side among a surface side substrate and a rear-face side substrate.

[0012] By such configuration, since a ferrite object was laid underground in a substrate, while being able to attain a miniaturization of a helical antenna according to the ferrite effect, a deployment of a substrate space can be attained.

[0013] Inside of the 1st virtual straight line which this invention drew in parallel mutually as an imaginary line on a front reverse side double-sided substrate, and the 2nd virtual straight line, While forming the 1st three or more penetration through holes in a substrate so that front reverse side double-sided substrates may be penetrated on the 1st virtual straight line 2nd at least three penetration through holes are formed in a double-sided substrate so that it may face alternately [ the 1st penetration through hole ] on the 2nd virtual straight line and a front reverse side double-sided substrate may be penetrated. Inside of 1st at least three penetration through holes, Among a surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of a front

reverse side double-sided substrate, or a rear-face side substrate, one opening side among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body in Yamagata. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 1st loop-like metal -- a line -- Furthermore A surface side substrate in the 1st penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed a opening side of another side, and on the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate Wiring connection is made with the body in Yamagata. or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore To a center-section side of a front reverse side double-sided substrate A surface side substrate in the 1st located penetration through hole Among a surface side substrate in the 2nd penetration through hole located in a center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on the 2nd virtual straight line among rear-face side substrates, or a rear-face side substrate, or one opening side Wiring connection is made with the body in Yamagata. inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 3rd loop-like metal -- a line -- Furthermore A surface side substrate [ in / among penetration through holes formed a opening side of another side, and on / at least three / the 1st virtual straight line among a surface side substrate in the 2nd penetration through hole located in a center-section side of a front reverse side double-sided substrate, or a rear-face side substrate / the 1st penetration through hole by the side of the other side edge section of a table reverse side double-sided substrate ] Wiring connection is made with the body in Yamagata. or inside of a rear-face side substrate -- a opening side of a substrate of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 4th loop-like metal -- a line -- Furthermore, inside of the 1st penetration through hole formed on [ at least three ] the 1st virtual straight line, A surface side substrate in the 2nd penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate formed a opening side of a substrate of another side, and on [ at least three ] the 2nd virtual straight line among a surface side substrate in the 1st penetration through hole by the side of the other side edge section of a front reverse side double-sided substrate, or a rear-face side substrate or inside of a rear-face side substrate -- a opening side of another side -- inside of a surface side substrate or a rear-face side substrate -- a substrate top of another side -- the 5th loop-like metal -- a line -- by making wiring connection with the body in Yamagata Connect to a surface side substrate and a rear-face substrate the 2nd penetration through hole formed in at least three substrates on the 1st penetration through hole formed in at least three substrates on the 1st virtual straight line, and the 2nd virtual straight line in the shape of [ alternate ] a spiral, and a helical antenna object is formed. It constitutes.

[0014] such a configuration -- each through hole -- a loop-like metal -- a line -- helical antenna \*\*\*\* with [ since wiring connection was made with the body in Yamagata ] the shape of a smooth screw type -- things are made.

[0015] this invention -- the 1st loop-like metal -- a line, while arranging the 1st ferrite object between substrates of another side among the body, the 3rd loop-like metal-like object, a surface side substrate, and a rear-face side substrate the 2nd loop-like metal -- a line -- the 2nd ferrite object is arranged and constituted between one substrates among the body, the 4th loop-like metal-like object, a surface side substrate, and a rear-face side substrate.

[0016] By such configuration, since a ferrite object was arranged in a surface [ of a substrate ], and rear-face side, a small helical antenna which reinforced the ferrite effect further can be obtained.

[0017] While laying the 1st ferrite object of this invention under the substrate of another side among a surface side substrate and a rear-face side substrate, the 2nd ferrite object is laid underground and constituted in one substrate among a surface side substrate and a rear-face side substrate.

[0018] By such configuration, since a ferrite object was laid under the surface [ of a substrate ], and rear-face side, a helical antenna which used the ferrite effect on a printed circuit board for mobile transmitters and which was miniaturized further can be obtained.

[0019]

[Embodiment of the Invention] Next, the gestalt of the operation in this invention is explained using a drawing.

[0020] Drawing 1 is the perspective diagram showing the antenna for mobile transmitters in the 1st example of this invention. Here, the penetration through holes 11, 12, 13, 14, 15, and 16 through which it pierced from surface 10a to rear-face 10b are formed in the printed circuit board 10.

Moreover, the 1st parallel imaginary line L and the 2nd imaginary line M are mutually drawn by surface 10a of a substrate, and rear-face 10b. The penetration through holes 11, 13, and 15 are located on the 1st imaginary line L, and the penetration through holes 12, 14, and 16 are located on the 2nd imaginary line M.

[0021] Moreover, the penetration through holes 11, 13, and 15 and the penetration through holes 12, 14, and 16 are arranged so that it may face alternately. and the rear-face side of the penetration through holes 11 and 12 -- a substrate top -- the 1st straight line-like metal -- a line -- the body 17 connects.

[0022] moreover, the surface side of the penetration through holes 12 and 13 -- a substrate top -- the 2nd straight line-like metal -- a line -- the body 18 connects. furthermore, the rear-face side of the penetration through holes 13 and 14 -- a substrate top -- the 3rd straight line-like metal -- a line -- the body 19 connects. moreover, the surface side of the penetration through holes 14 and 15 -- a substrate top -- the 4th straight line-like metal -- a line -- the body 20 connects. moreover, the rear-face side of the penetration through holes 15 and 16 -- a substrate top -- the 5th straight line-like metal -- a line -- the body 21 connects.

[0023] thus, each penetration through holes 11-16 -- the 1- the 5th straight line-like metal -- a line -- the bodies 17-21 connect so that a spiral may be drawn, and a helical antenna object is formed with them. Moreover, one edge of a helical antenna object is connected to the wireless section connection 22.

[0024] By the above configurations, a spiral helical antenna can be manufactured on the printed circuit board for mobile transmitters. In addition, although the above example explained the example which the number of penetration through holes arranged at a time on [ three ] 3 on the 1st imaginary line L, and the 2nd imaginary line M, the same effect is acquired even if it is more than it.

[0025] Drawing 2 is the perspective diagram showing the antenna for mobile transmitters in the 2nd example of this invention. The inside of the 1st virtual straight line L which drew in parallel mutually as an imaginary line in this example on the front reverse side double-sided substrate of a printed circuit board 10, and the 2nd virtual straight line M, While forming the 1st three or more penetration through holes 11, 13, and 15 in a substrate 10 so that front reverse side double-sided substrates may be penetrated on the 1st virtual straight line L 2nd at least three penetration through holes 12, 14, and 16 are formed in a double-sided substrate so that it may face alternately [ the 1st penetration through hole 11, 13 and 15 ] on the 2nd virtual straight line M and a front reverse side double-sided substrate may be penetrated. The inside of 1st at least three penetration through holes 11, 13, and 15, Among the surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate, one opening side among the surface side substrate in the 2nd penetration through hole 12, 14, and 16 by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body 23. the inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 1st straight line-like metal -- a line -- Furthermore The 2nd penetration through hole 12 and 14 by the side of the 1 side edge section of a front reverse side double-sided substrate, The surface side substrate in 16 Among the surface side substrate in the 1st penetration through hole located in the center-section side of a table reverse side double-sided substrate among at least three penetration through holes 11, 13, and 15 formed 1st on [ L ] the virtual straight line the opening side of another side among rear-face side substrates, or a rear-face side substrate, or the opening side of another side Wiring connection is made with the body 24 in Yamagata. the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 1st loop-like metal -- a line -- Furthermore At least three penetration through holes 12 formed 2nd on [ M ] the virtual straight line one opening side among the surface side substrate in the 1st penetration through hole 13 located in the center-section side of a front reverse side double-sided substrate, or the rear-face side substrate, Wiring connection is made with the body 25. the inside of the surface side substrate in the 14 and 2nd penetration through hole 14 which are

located in the center-section side of a table reverse side double-sided substrate among 16, or a rear-face side substrate -- one opening side -- the inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 2nd straight line-like metal -- a line -- further To the center-section side of a front reverse side double-sided substrate The surface side substrate in the 2nd located penetration through hole 14 Among the penetration through holes formed among rear-face side substrates the opening side of another side, and on [ at least three ] the 1st virtual straight line, among the surface side substrate in the 1st penetration through hole 15 by the side of the other side edge section of a table reverse side double-sided substrate, or a rear-face side substrate or the opening side of the substrate of another side Wiring connection is made with the body 26 in Yamagata. the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore, the inside of the 1st penetration through hole formed on [ at least three ] the 1st virtual straight line, The surface side substrate in the 2nd penetration through hole 16 by the side of the other side edge section of the front reverse side double-sided substrate formed the opening side of the substrate of another side, and on [ at least three ] the 2nd virtual straight line among the surface side substrate in the 1st penetration through hole 15 by the side of the other side edge section of a front reverse side double-sided substrate, or the rear-face side substrate or the inside of a rear-face side substrate -- the opening side of another side -- the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 3rd straight line-like metal -- a line -- by making wiring connection with the body 27 The 2nd penetration through hole 12, 14, and 16 formed in at least three substrates on the 1st penetration through hole 11, 13, and 15 formed in at least three substrates on the 1st virtual straight line, and the 2nd virtual straight line Said surface side substrate And it connects with a rear-face substrate in the shape of [ alternate ] a spiral, and a helical antenna object is formed and constituted.

[0026] By the above configurations, the helical antenna formed on the printed circuit board for mobile transmitters can be close brought in the shape of [ smooth ] a screw type.

[0027] Drawing 3 is the perspective diagram showing the antenna for mobile transmitters in the 3rd example of this invention. here -- the penetration through hole [ on a printed circuit board 10 ] 11-16, 1st, 2nd, and 3rd straight line-like metal -- a line -- the body 23, 25, and 27 and 1st, and 2nd loop-like metal -- a line -- since the configuration of the bodies 24 and 26 is the same as that of the 2nd example, explanation is omitted. this example -- the 1st loop-like metal -- a line -- the body 24 and the 2nd loop-like metal -- a line -- the ferrite object 28 is arranged between the body 26 and a printed circuit board 10.

[0028] this example constituted as mentioned above -- the ferrite object 28 -- a loop-like metal -- a line -- since it arranged between the body and a printed circuit board, the further miniaturization of a helical antenna can be attained according to the ferrite effect.

[0029] Drawing 4 is the perspective diagram showing the antenna for mobile transmitters in the 4th example of this invention. this example -- setting -- the surface side of a printed circuit board 10 -- the 1st and 2nd loop-like metal -- a line -- the concave 29 for laying the ferrite object 28 under the bottom of the bodies 24 and 26 is formed, and a ferrite object is laid underground in this concave 29.

[0030] Since the ferrite object was laid underground in the printed circuit board when constituted as mentioned above, the further miniaturization of a helical antenna can be attained.

[0031] Drawing 5 is the perspective diagram showing the antenna for mobile transmitters in the 5th example of this invention. The inside of the 1st virtual straight line L which drew in parallel mutually as an imaginary line on the front reverse side double-sided substrate in this example, and the 2nd virtual straight line M, While forming the 1st three or more penetration through holes 11, 13, and 15 in a substrate so that front reverse side double-sided substrates may be penetrated on the 1st virtual straight line L 2nd at least three penetration through holes 12, 14, and 16 are formed in a double-sided substrate so that it may face alternately [ the 1st penetration through hole 11, 13 and 15 ] 2nd on [ M ] a virtual straight line and a front reverse side double-sided substrate may be penetrated. The inside of 1st at least three penetration through holes 11, 13, and 15, Among the surface side substrate in the 1st penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate, one opening side among the surface side substrate in the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate, or a rear-face side substrate one opening side Wiring connection is made with the body 30 in Yamagata. the inside of a surface side substrate or a

rear-face side substrate -- one substrate top -- the 1st loop-like metal -- a line -- Furthermore To the 2nd penetration through hole by the side of the 1 side edge section of a front reverse side double-sided substrate Among the surface side substrate in the 1st penetration through hole 13 located in the center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed the opening side of another side, and on the 1st virtual straight line among the surface side substrate which can be set, or the rear-face side substrate, or a rear-face side substrate, the opening side of another side Wiring connection is made with the body 31 in Yamagata. the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 2nd loop-like metal -- a line -- Furthermore To the center-section side of a front reverse side double-sided substrate The surface side substrate in the 1st located penetration through hole 13 Among the surface side substrate in the 2nd penetration through hole 14 located in the center-section side of a table reverse side double-sided substrate among at least three penetration through holes formed one opening side and on the 2nd virtual straight line among rear-face side substrates, or a rear-face side substrate, or one opening side Wiring connection is made with the body 32 in Yamagata. the inside of a surface side substrate or a rear-face side substrate -- one substrate top -- the 3rd loop-like metal -- a line -- Furthermore To the center-section side of a front reverse side double-sided substrate The surface side substrate in the 2nd located penetration through hole Among the penetration through holes formed among rear-face side substrates the opening side of another side, and on [ at least three ] the 1st virtual straight line, among the surface side substrate in the 1st penetration through hole 15 by the side of the other side edge section of a table reverse side double-sided substrate, or a rear-face side substrate or the opening side of the substrate of another side Wiring connection is made with the body 33 in Yamagata. the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 4th loop-like metal -- a line -- Furthermore, the inside of the 1st penetration through hole formed on [ at least three ] the 1st virtual straight line, The surface side substrate in the 2nd penetration through hole 16 by the side of the other side edge section of the front reverse side double-sided substrate formed the opening side of the substrate of another side, and on [ at least three ] the 2nd virtual straight line among the surface side substrate in the 1st penetration through hole 15 by the side of the other side edge section of a front reverse side double-sided substrate, or the rear-face side substrate or the inside of a rear-face side substrate -- the opening side of another side -- the inside of a surface side substrate or a rear-face side substrate -- the substrate top of another side -- the 5th loop-like metal -- a line -- by making wiring connection with the body 34 in Yamagata The 2nd penetration through hole 12, 14, and 16 formed in at least three substrates on the 1st penetration through hole 11, 13, and 15 formed in at least three substrates on the 1st virtual straight line L, and the 2nd virtual straight line A surface side substrate And it connects with a rear-face substrate in the shape of [ alternate ] a spiral, and a helical antenna object is formed.

[0032] the case where it constitutes as mentioned above -- each penetration through holes 11-16 -- each loop-like metal -- a line -- since it connected with the bodies 30-34, the helical antenna of the shape of a smooth screw type can be manufactured on a printed circuit board.

[0033] Drawing 6 is the perspective diagram showing the antenna for mobile transmitters in the 6th example of this invention. this example -- setting -- the 1st loop-like metal -- a line -- while arranging the 1st ferrite object 35 between the body 30, the 3rd loop-like metal-like object 32, and substrate surface 10a -- the 2nd loop-like metal -- a line -- the 2nd ferrite object 36 is arranged and constituted between the body 31, and the 4th loop-like metal-like \*\*\*\* 33 \*\* and substrate rear-face 10b.

[0034] the case where it constitutes as mentioned above -- each penetration through holes 11-16 -- each loop-like metal -- a line -- since it connected with the bodies 30-34, while being able to do with the shape of a smooth screw type, the miniaturization of a helical antenna can be attained according to the ferrite effect.

[0035] Drawing 7 is the perspective diagram showing the antenna for mobile transmitters in the 7th example of this invention. In this example, while forming a concave 37 in surface 10a of a substrate and laying the 1st ferrite object 35 under it, a concave 38 is formed, and the 2nd ferrite object 36 is laid under the rear-face 10b of a substrate, and is constituted in it.

[0036] When constituted as mentioned above, while arranging a ferrite object in the surface and the rear face of a printed circuit board, since it laid under the substrate, the ferrite effect can attain the

further miniaturization of a helical antenna.

[0037] Drawing 8 is the block diagram showing the diversity antenna for mobile transmitters in the 8th example of this invention. Here, the 1st helical antenna 39 and 2nd helical antenna 40 have been arranged so that it may intersect perpendicularly mutually, and this two helical antenna is connected with the wireless section connection 42 possible [ a change ] by the RF circuit changing switch 41.

[0038] Even when are constituted as mentioned above and the electric wave which a mobile transmitter reaches carries out polarization, the diversity antenna for mobile transmitters receivable to fitness can be offered by switching the RF circuit changing switch 41.

[0039] Drawing 9 is the block diagram showing the diversity antenna for mobile transmitters in the 9th example of this invention. In this example, the 1st helical antenna 43 and 2nd helical antenna 44 are connected to the wireless section connection 47 through the transmission lines 45 and 46 of quarter-wave length ( $\lambda$ ), respectively while they are arranged so that it may intersect perpendicularly mutually. Moreover, the RF ON/OFF switches 48 and 49 are connected between the 1st and 2nd helical antenna and the transmission lines 45 and 46 of quarter-wave length. These RF ON/OFF switches 48 and 49 have composition which interlocks so that another side may serve as OFF, when either is turned ON.

[0040] Reception good [ without receiving effect in the polarization of a mobile transmitter ] is possible, without using a RF circuit changing switch like the 8th example in the case of the diversity antenna for mobile transmitters constituted as mentioned above.

[0041] Drawing 10 is the block diagram showing the diversity antenna for mobile transmitters in the 10th example of this invention. In this example, the nondirectional antenna 50 and the directional antenna 51 are connected to the wireless section connection 53 possible [ a change ] by the RF circuit changing switch 52.

[0042] When are constituted as mentioned above and a mobile transmitter is in the weak location of a received electric wave, gain can be raised using a directional antenna 51. Moreover, it can be used in the good location of an electric wave condition, being able to switch to a nondirectional antenna 50.

[0043] Drawing 11 is the perspective diagram showing the diversity antenna for mobile transmitters in the 11th example of this invention. In this example, the directional antenna 55 is formed on the printed circuit board 54, and the directional antenna 55 and nondirectional antenna 50 on a substrate are connected to the wireless section connection 53 possible [ a change ] by the RF circuit changing switch 52.

[0044] When are constituted as mentioned above and a mobile transmitter is in the weak location of a received electric wave, gain can be raised using a directional antenna 55. Moreover, since the directional antenna was formed on the printed circuit board, the miniaturization of equipment can be attained.

[0045] Drawing 12 is the perspective diagram showing the diversity antenna for mobile transmitters in the 12th example of this invention. In this example, the 1st and 2nd directional antenna 56 and 57 which differed in the directive direction mutually was formed on the printed circuit board, and the directional-antenna group 59 and nondirectional antenna 50 which were connected possible [ a change ] by the RF circuit changing switch 58 are connected to the wireless section connection 53 possible [ a change ] by the RF circuit changing switch 52.

[0046] When are constituted as mentioned above, and the received electric wave of a mobile transmitter is weak, while being able to use it, being able to switch to the directional-antenna group 59, orientation can be chosen from two or more directional antennas, and the antenna of high gain can be used. Therefore, gain can be raised also in the weak location of an electric wave.

[0047]

[Effect of the Invention] Since according to this invention the penetration through hole was alternately formed in parallel on the printed circuit board, the edge of these penetration through holes was connected so that the whole might draw a spiral, and the helical antenna was constituted, the small antenna for mobile transmitters can be obtained.

#### **[Brief Description of the Drawings]**

[Drawing 1] The perspective diagram showing the antenna for mobile transmitters in the 1st example of this invention

[Drawing 2] The perspective diagram showing the antenna for mobile transmitters in the 2nd example of this invention

[Drawing 3] The perspective diagram showing the antenna for mobile transmitters in the 3rd example of this invention

[Drawing 4] The perspective diagram showing the antenna for mobile transmitters in the 4th example of this invention

[Drawing 5] The perspective diagram showing the antenna for mobile transmitters in the 5th example of this invention

[Drawing 6] The perspective diagram showing the antenna for mobile transmitters in the 6th example of this invention

[Drawing 7] The perspective diagram showing the antenna for mobile transmitters in the 7th example of this invention

[Drawing 8] The block diagram showing the diversity antenna for mobile transmitters in the 8th example of this invention

[Drawing 9] The block diagram showing the diversity antenna for mobile transmitters in the 9th example of this invention

[Drawing 10] The block diagram showing the diversity antenna for mobile transmitters in the 10th example of this invention

[Drawing 11] The perspective diagram showing the diversity antenna for mobile transmitters in the 11th example of this invention

[Drawing 12] The perspective diagram showing the diversity antenna for mobile transmitters in the 12th example of this invention

[Drawing 13] The block diagram showing the conventional helical antenna for mobile transmitters

[Description of Notations]

L The 1st imaginary line

M The 2nd imaginary line

10 Printed Circuit Board

10a Surface

10b Rear face

11-16 Penetration through hole

17 Straight Line-like Metal Wire-like Object Which is the 1st

18 Straight Line-like Metal Wire-like Object Which is the 2nd

19 Straight Line-like Metal Wire-like Object Which is the 3rd

20 Straight Line-like Metal Wire-like Object Which is the 4th

21 Straight Line-like Metal Wire-like Object Which is the 5th

22 Wireless Section Connection

23 Straight Line-like Metal Wire-like Object Which is the 1st

24 1st Loop-like Metal -- Line -- Body

25 Straight Line-like Metal Wire-like Object Which is the 2nd

26 2nd Loop-like Metal -- Line -- Body

27 Straight Line-like Metal Wire-like Object Which is the 3rd

28 Ferrite Object

29 Concave

30 1st Loop-like Metal -- Line -- Body

31 2nd Loop-like Metal -- Line -- Body

32 3rd Loop-like Metal -- Line -- Body

33 4th Loop-like Metal -- Line -- Body

34 5th Loop-like Metal -- Line -- Body

35 1st Ferrite Object

36 2nd Ferrite Object

37 38 Concave

39 1st Helical Antenna

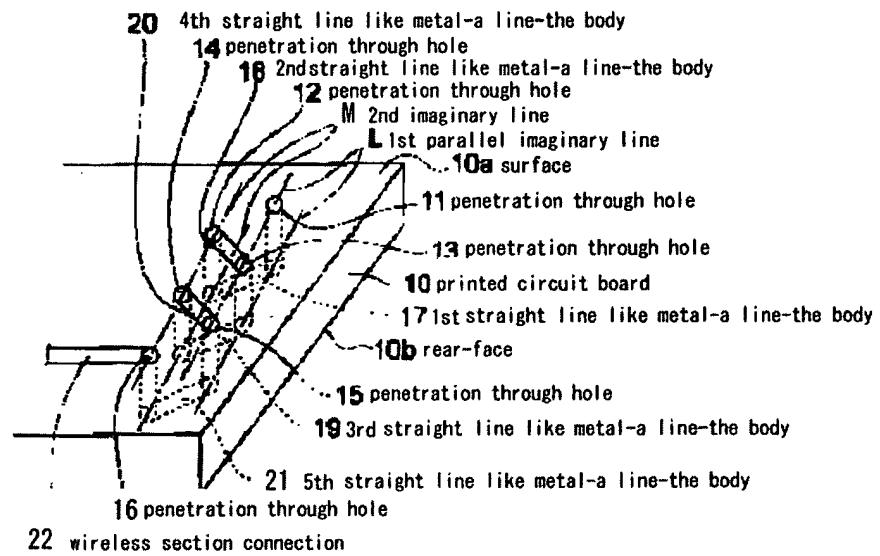
40 2nd Helical Antenna

41 RF Circuit Changing Switch

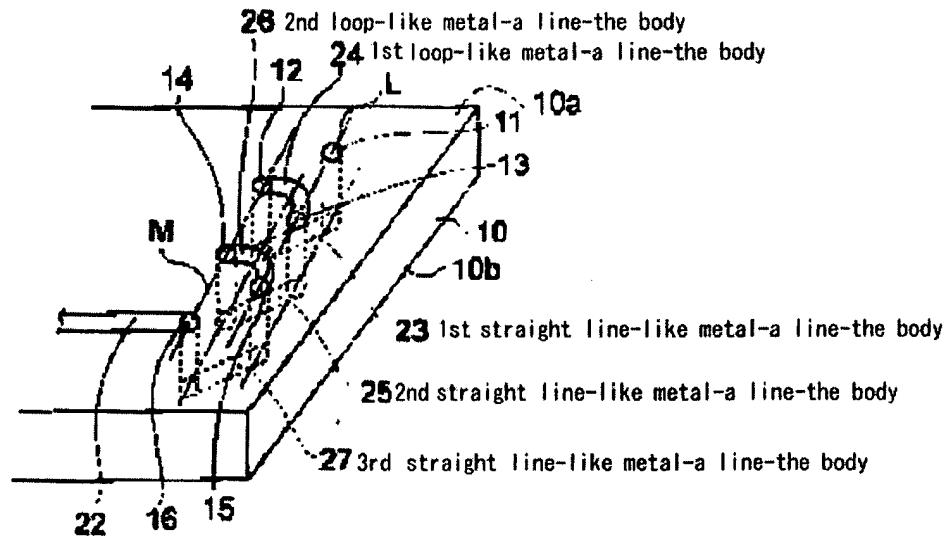
42 Wireless Section Connection

- 43 1st Helical Antenna
- 44 2nd Helical Antenna
- 45 46 Transmission line
- 47 Wireless Section Connection
- 48 49 RF ON/OFF switch
- 50 Nondirectional Antenna
- 51 Directional Antenna
- 52 RF Circuit Changing Switch
- 53 Wireless Section Connection
- 54 Printed Circuit Board
- 55 Directional Antenna
- 56 1st Directional Antenna
- 57 2nd Directional Antenna
- 58 RF Circuit Changing Switch
- 59 Directional-Antenna Group

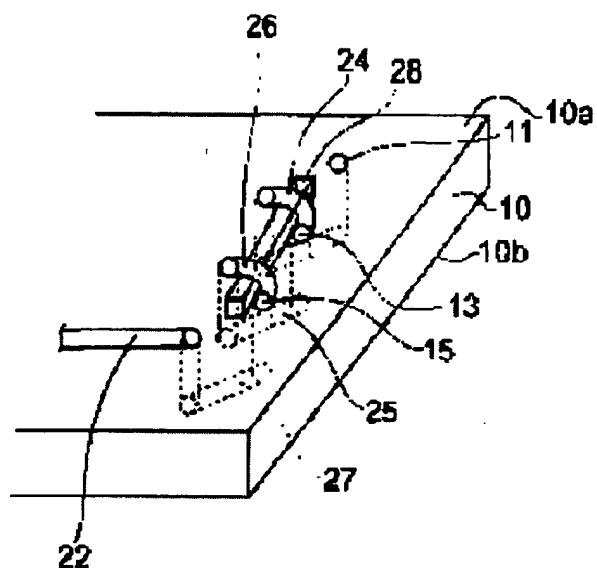
**Drawings**  
[FIG.1]



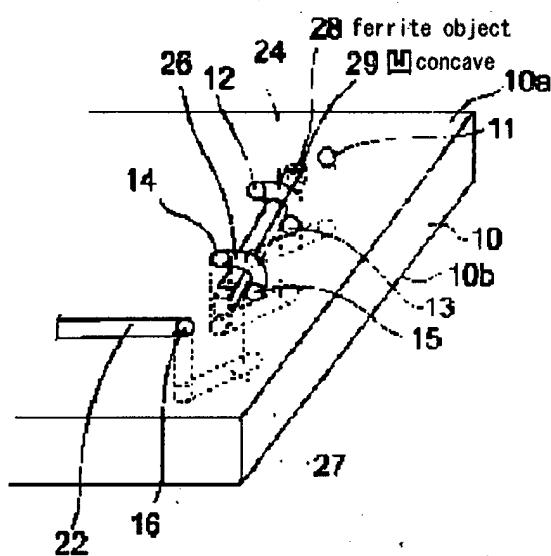
[FIG.2]



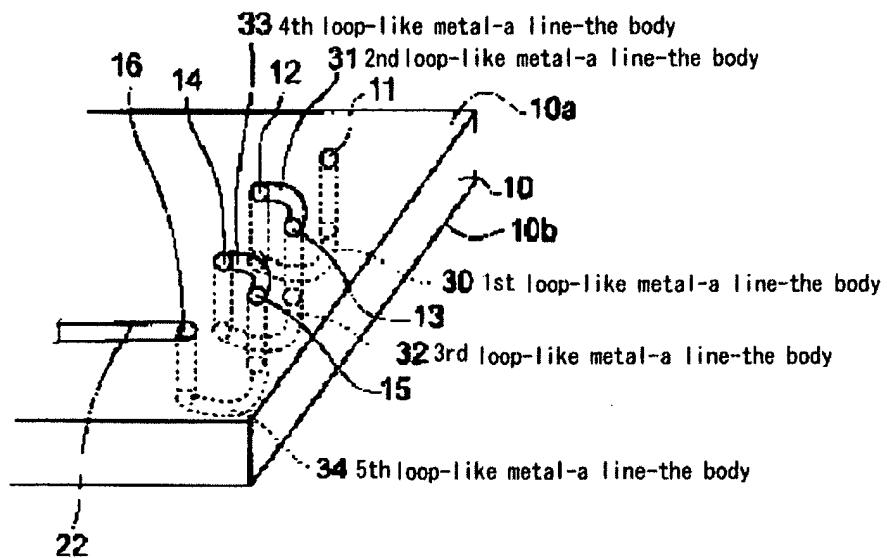
[FIG.3]



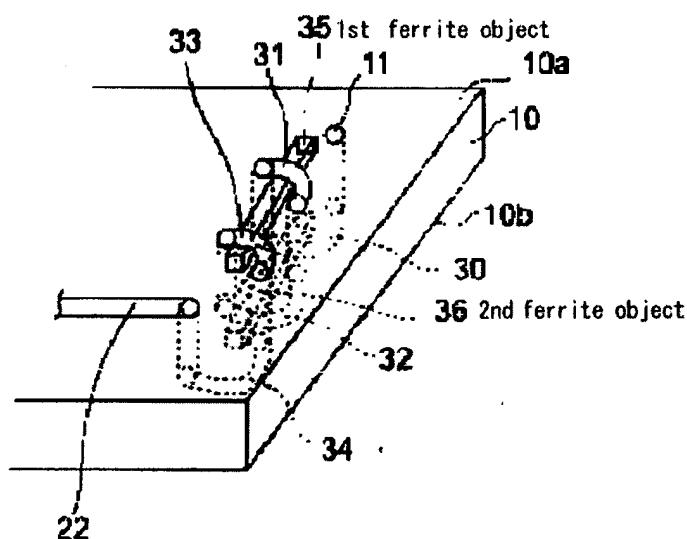
[FIG.4]



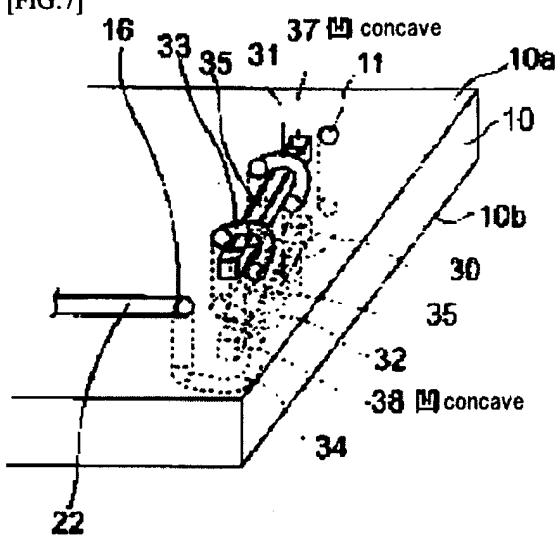
[FIG.5]



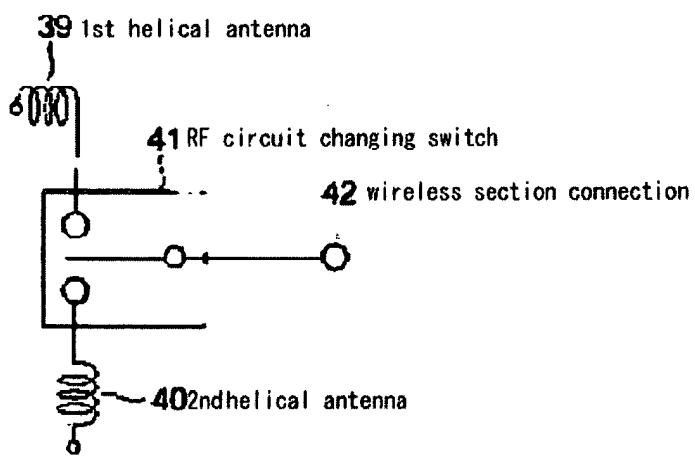
[FIG.6]



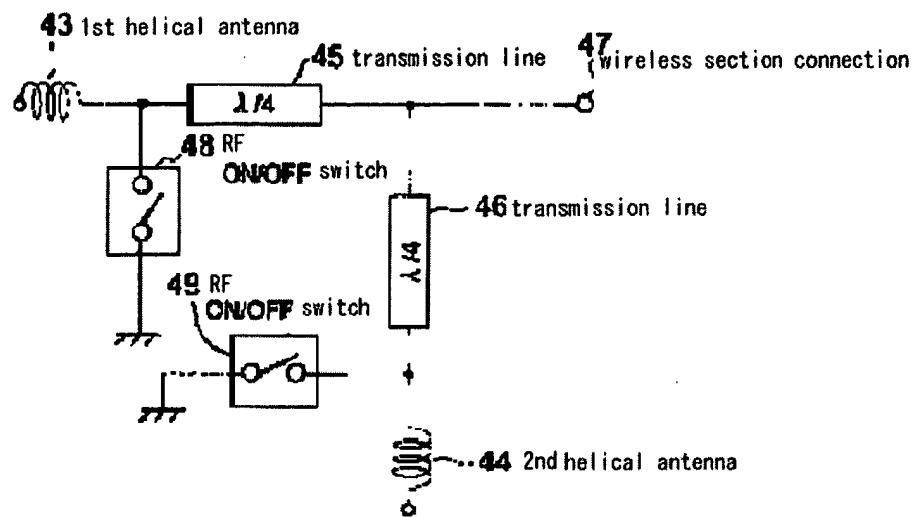
[FIG.7]



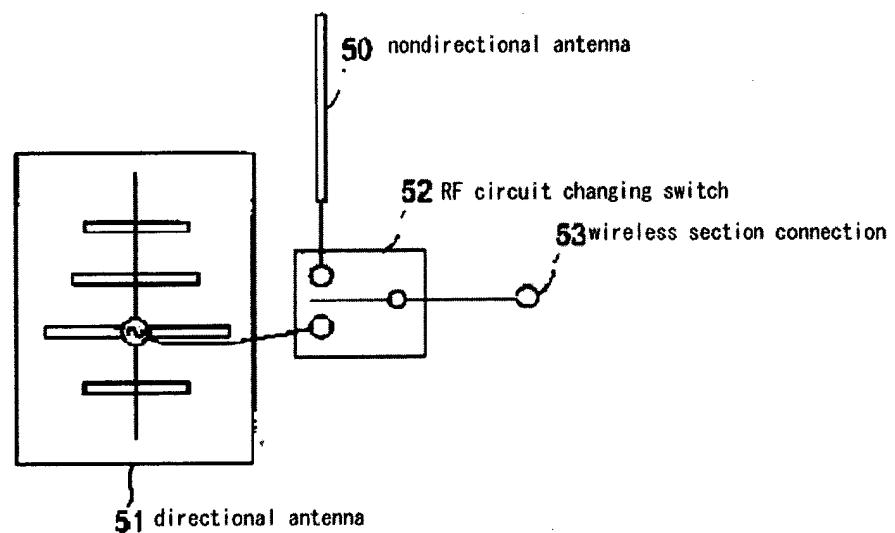
[FIG.8]



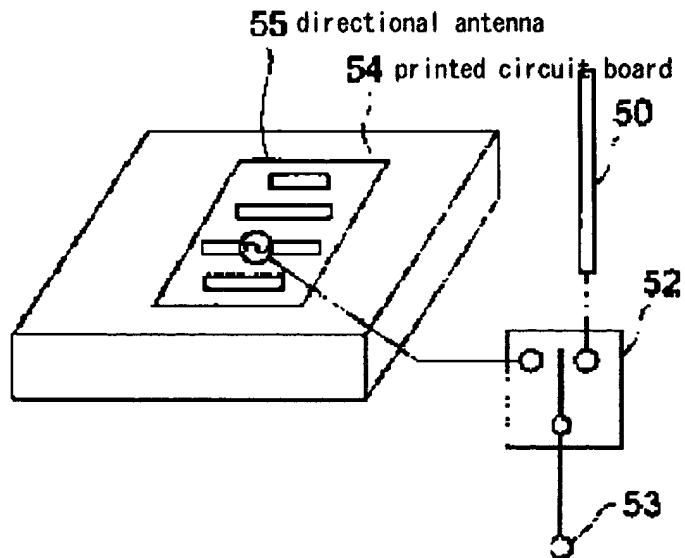
[FIG.9]



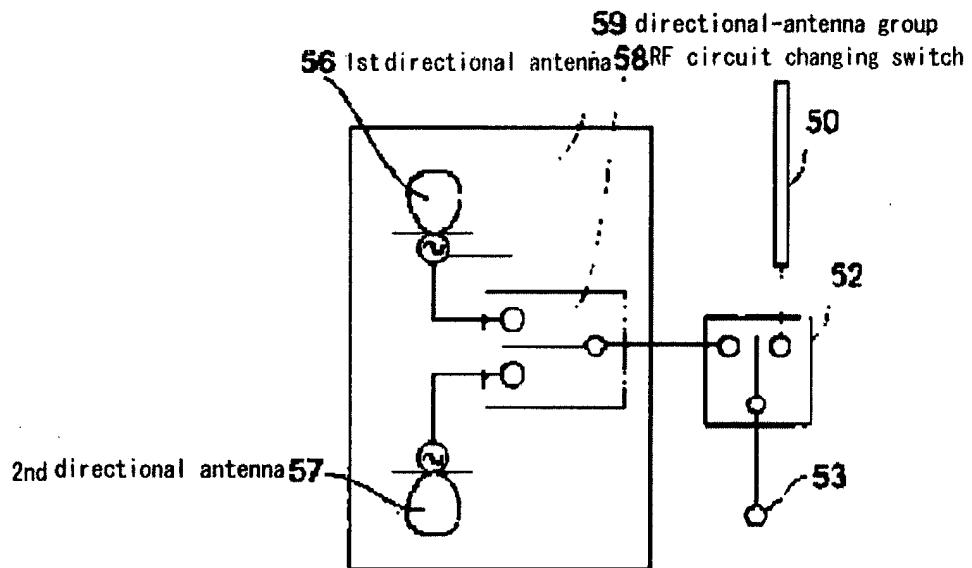
[FIG.10]



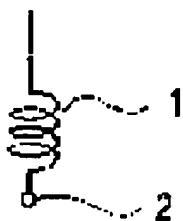
[FIG.11]



[FIG.12]



[FIG.13]



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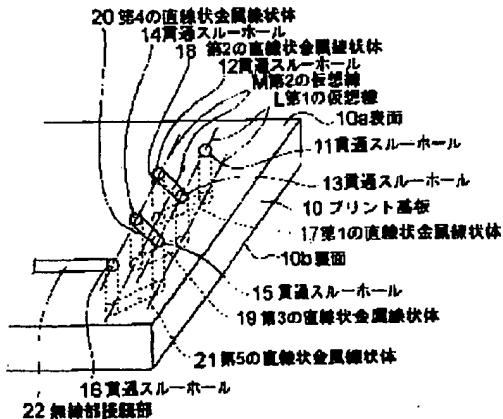
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(54)【発明の名称】 移動体通信機用アンテナ

(57)【要約】

【課題】 プリント基板上に製作することができる小型の移動体通信機用アンテナを提供する。

【解決手段】 無線部を構成するプリント基板10上に貫通スルーホール11～16を互い違いに平行に形成し、これらの貫通スルーホールの端部を全体が螺旋を描く様に接続してヘリカルアンテナを構成したので、小型の移動体通信機用アンテナを得ることができる。



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### 【特許請求の範囲】

【請求項1】 表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線および第2の仮想直線のうち、前記第1の仮想直線上において前記表裏両面基板同士を貫通するように前記基板に3個以上の第1の貫通スルーホールを形成するとともに、前記第2の仮想直線上において前記第1の貫通スルーホールとは互い違いに向き合うように前記表裏両面基板を貫通するように前記両面基板に少なくとも3個の第2の貫通スルーホールを形成しており、

前記少なくとも 3 個の第 1 の貫通スルーホールのうち、前記表裏両面基板の一側端部側の第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記表裏両面基板の一側端部側の第 2 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側とを前記表面側基板又は裏面側基板のうち一方の基板上で第 1 の直線状金属線状体により配線接続し、更に、前記表裏両面基板の一側端部側の第 2 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側と前記第 1 の仮想直線上に形成した少なくとも 3 個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で第 2 の直線状金属線状体に配線接続し、更に、前記表裏両面基板の中央部側に位置する前記第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記第 2 の仮想直線上に形成した少なくとも 3 個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第 2 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記第 2 の仮想直線上に形成した少なくとも 3 個の貫通スルーホールのうち前記表裏両面基板の他側端部側の第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の基板の開口側と前記表面側基板又は裏面側基板のうち他方の基板上で第 4 の直線状金属線状体に配線接続し、更に、前記第 1 の仮想直線上に少なくとも 3 個形成した第 1 の貫通スルーホールのうち、前記表裏両面基板の他側端部側の第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の基板の開口側と前記第 2 の仮想直線上に少なくとも 3 個形成した前記表裏両面基板の他側端部側の第 2 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側と前記表面側基板又は裏面側基板のうち他方の基板上で第 5 の直線状金属線状体に配線接続することによって、前記第 1 の仮想直線上における前記基板に少なく

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とも3個形成した第1の貫通スルーホール及び前記第2の仮想直線上における前記基板に少なくとも3個形成した第2の貫通スルーホールを前記表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成したことを特徴とする移動体通信機用アンテナ。

【請求項 2】 表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線および第2の仮想直線のうち

10 士を貫通するように前記基板に3個以上の第1の貫通スルーホールを形成するとともに、前記第2の仮想直線上において前記第1の貫通スルーホールとは互い違いに向き合うように前記表裏両面基板を貫通するように前記両面基板に少なくとも3個の第2の貫通スルーホールを形成しており。

前記少なくとも 3 個の第 1 の貫通スルーホールのうち、前記表裏両面基板の一側端部側の第 1 の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記表裏両面基板の一側端部側の第 2 の貫通ス

20 ルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側とを前記表面側基板又は裏面側基板のうち一方の基板上で第1の直線状金属線状体により配線接続し、更に、前記表裏両面基板の一側端部側の第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側と前記第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で

30 第1のループ状金属線状体により山形に配線接続し、更に、前記表裏両面基板の中央部側に位置する前記第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側とを前記表面側基板又は裏面側基板のうち一方の基板上で第2の直線状金属線状体により配線接続し、更に、前記表裏両面基板の中央部側に位置する前記第2の貫通ス

40 ルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と前記第1の仮想直線上に少なくとも3個形成した貫通スルーホールのうち前記表裏両面基板の他側端部側の第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の基板の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で第2のループ状金属線状体により山形に配線接続し、更に、前記第1の仮想直線上に少なくとも3個形成した第1の貫通スルーホールのうち、前記表裏両面基板の他側端部側の第1の貫通スルーホールにおける前記表面側基板又は裏

### 50 面側基板のうち他方の基板の開口側と前記第2の仮想直

線に少なくとも3個形成した前記表裏両面基板の他側端部側の第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で第3の直線状金属線状体により配線接続することによって、前記第1の仮想直線上における前記基板に少なくとも3個形成した第1の貫通スルーホール及び前記第2の仮想直線上における前記基板に少なくとも3個形成した第2の貫通スルーホールを前記表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成することを特徴とする移動体通信機用アンテナ。

【請求項3】 前記第1のループ状金属線状体と前記第2のループ状金属線状体及び表面側基板及び裏面側基板のうち他方の基板との間にフェライト体を配設することを特徴とする請求項2記載の移動体通信機用アンテナ。

【請求項4】 前記フェライト体を表面側基板及び裏面側基板のうち他方の基板に埋設したことを特徴とする請求項3記載の移動体通信機用アンテナ。

【請求項5】 表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線および第2の仮想直線のうち、前記第1の仮想直線上において前記表裏両面基板同士を貫通するように前記基板に3個以上の第1の貫通スルーホールを形成するとともに、前記第2の仮想直線上において前記第1の貫通スルーホールとは互い違いに向き合うように前記表裏両面基板を貫通するように前記両面基板に少なくとも3個の第2の貫通スルーホールを形成しており、

前記少なくとも3個の第1の貫通スルーホールのうち、前記表裏両面基板の一側端部側の第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記表裏両面基板の一側端部側の第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記表面側基板又は裏面側基板のうち一方の基板上で第1のループ状金属線状体により山形に配線接続し、更に、前記表裏両面基板の一側端部側の第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側と前記第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側と前記表面側基板又は裏面側基板のうち他方の基板上で第2のループ状金属線状体により山形に配線接続し、更に、前記表裏両面基板の中央部側に位置する前記第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち前記表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち一方の開口側と前記表面側基板又は裏面側基板のうち一方の基板上で第3のループ状金属線状体により山形に配線接続し、更に、前記表面側基板又は裏面側基板のうち一方の開口側と前記表面側基板又は裏面側基板のうち一方の基板上で第3のループ状金属線状体により山形に配線接続することを特徴とする請求項5記載の移動体通信機用アンテナ。

接続し、更に、前記表裏両面基板の中央部側に位置する前記第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と前記第1の仮想直線上に少なくとも3個形成した貫通スルーホールのうち前記表裏両面基板の他側端部側の第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の基板の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で第4のループ状金属線状体により山形に配線接続し、更に、前記第1の仮想直線上に少なくとも3個形成した第1の貫通スルーホールのうち、前記表裏両面基板の他側端部側の第1の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の基板の開口側と前記第2の仮想直線上に少なくとも3個形成した前記表裏両面基板の他側端部側の第2の貫通スルーホールにおける前記表面側基板又は裏面側基板のうち他方の開口側とを前記表面側基板又は裏面側基板のうち他方の基板上で第5のループ状金属線状体により山形に配線接続することによって、前記第1の仮想直線上における前記基板に少なくとも3個形成した第1の貫通スルーホール及び前記第2の仮想直線上における前記基板に少なくとも3個形成した第2の貫通スルーホールを前記表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成することを特徴とする移動体通信機用アンテナ。

【請求項6】 前記第1のループ状金属線状体と前記第3のループ状金属線状体及び、表面側基板及び裏面側基板のうち他方の基板との間に第1のフェライト体を配設するとともに、前記第2のループ状金属線状体と前記第4のループ状金属線状体及び、表面側基板及び裏面側基板のうち一方の基板との間に第2のフェライト体を配設して構成したことを特徴とする請求項5記載の移動体通信機用アンテナ。

【請求項7】 前記第1のフェライト体を表面側基板及び裏面側基板のうち他方の基板に埋設するとともに、前記第2のフェライト体を表面側基板及び裏面側基板のうち一方の基板に埋設して構成したことを特徴とする請求項6記載の移動体通信機用アンテナ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、UHF (Ultra High Frequency) 及びマイクロ波帯の電波を使用した携帯電話、PHS等の移動体通信機用アンテナに関するものである。

【0002】

【従来の技術】 従来の携帯電話等の移動体通信機用アンテナは、例えば図13に示すように、金属線を螺旋状に巻いたヘリカルアンテナ1が使用されている。ここに示されたヘリカルアンテナ1は、直線状のダイポールアンテナに比べて寸法を短く、小型にすることができる。

【0003】

【発明が解決しようとする課題】しかしながら、従来のヘリカルアンテナ1は、移動体通信機用に使用する場合、アンテナを保持するための機構が必要であり、携帯電話等の小型化の妨げとなっていた。また、アンテナ特性にバラツキが生じる虞もあった。

【0004】本発明は、従来のかかる点に鑑みなされたもので、アンテナ保持機構の簡素化と、アンテナ特性のバラツキの低減が達成できる移動体通信機用アンテナを提案するものである。

[0005]

【課題を解決するための手段】本発明は、表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線および第2の仮想直線のうち、第1の仮想直線上において表裏両面基板同士を貫通するように基板に3個以上の第1の貫通スルーホールを形成するとともに、第2の仮想直線上において第1の貫通スルーホールとは互い違いに向き合うように表裏両面基板を貫通するように両面基板に少なくとも3個の第2の貫通スルーホールを形成しており、少なくとも3個の第1の貫通スルーホールのうち、表裏両面基板の一側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側とを表面側基板又は裏面側基板のうち一方の基板上で第1の直線状金属線状体により配線接続し、更に、表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第2の直線状金属線状体に配線接続し、更に、表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と表面側基板又は裏面側基板のうち一方の基板上で第3の直線状金属線状体に配線接続し、更に、表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の他側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側と表面側基板又は裏面側基板のうち他方の基板上で第4の直線状金属線状体に配線接続し、更に、第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の他側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側と

第2の仮想直線上に少なくとも3個形成した表裏両面基板の他側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第5の直線状金属線状体に配線接続することによって、第1の仮想直線上における基板に少なくとも3個形成した第1の貫通スルーホール及び第2の仮想直線上における基板に少なくとも3個形成した第2の貫通スルーホールを表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成したものである。

体により山形に配線接続し、更に、第1の仮想直線上に少なくとも3個形成した第1の貫通スルーホールのうち、表裏両面基板の他側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側と第2の仮想直線上に少なくとも3個形成した表裏両面基板の他側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第3の直線状金属線状体により配線接続することによって、第1の仮想直線上における基板に少なくとも3個形成した第1の貫通スルーホール及び第2の仮想直線上における基板に少なくとも3個形成した第2の貫通スルーホールを表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成したものである。

【0008】本発明によれば、移動体通信機用のプリント基板上に螺旋状のヘリカルアンテナ形成することができ、装置の小型化が図れる。

【0009】本発明は、第1のループ状金属線状体と第2のループ状金属線状体及び表面側基板及び裏面側基板のうち他方の基板との間にフェライト体を配設したものである。

【0010】本発明によれば、ヘリカルアンテナにフェライト体を配設したので、フェライト効果によって、ヘリカルアンテナの更なる小型化が達成できる。

【0011】本発明は、フェライト体を表面側基板及び裏面側基板のうち他方の基板に埋設したものである。

【0012】このような構成により、フェライト体を基板内に埋設したので、フェライト効果によってヘリカルアンテナの小型化が図れると共に、基板スペースの有効利用が達成できる。

〔0013〕本発明は、表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線および第2の仮想直線のうち、第1の仮想直線上において表裏両面基板同士を貫通するように基板に3個以上の第1の貫通スルーホールを形成するとともに、第2の仮想直線上において第1の貫通スルーホールとは互い違いに向き合うように表裏両面基板を貫通するように両面基板に少なくとも3個の第2の貫通スルーホールを形成しており、少なくとも3個の第1の貫通スルーホールのうち、表裏両面基板の一側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側とを表面側基板又は裏面側基板のうち一方の基板上で第1のループ状金属線状体により山形に配線接続し、更に、表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第1の貫通スルーホ

一側における表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第2のループ状金属線状体により山形に配線接続し、更に、表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側とを表面側基板又は裏面側基板のうち一方の基板上で第3のループ状金属線状体により山形に配線接続し、更に、表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に少なくとも3個形成した貫通スルーホールのうち表裏両面基板の他側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第4のループ状金属線状体により山形に配線接続し、更に、第1の仮想直線上に少なくとも3個形成した第1の貫通スルーホールのうち、表裏両面基板の他側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側と第2の仮想直線上に少なくとも3個形成した表裏両面基板の他側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の基板の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第5のループ状金属線状体により山形に配線接続することによって、第1の仮想直線上における基板に少なくとも3個形成した第1の貫通スルーホール及び第2の仮想直線上における基板に少なくとも3個形成した第2の貫通スルーホールを表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成したものである。

【0014】このような構成により、各スルーホールをループ状金属線状体により山形に配線接続したので、円滑な螺旋形状を有したヘリカルアンテナ得ることができる。

【0015】本発明は、第1のループ状金属線状体と第3のループ状金属状体及び、表面側基板及び裏面側基板のうち他方の基板との間に第1のフェライト体を配設するとともに、第2のループ状金属線状体と第4のループ状金属状体及び、表面側基板及び裏面側基板のうち一方の基板との間に第2のフェライト体を配設して構成したものである。

【0016】このような構成により、フェライト体を基板の表面側と裏面側とに配設したので、フェライト効果を更に増強した小型のヘリカルアンテナを得ることができる。

【0017】本発明の第1のフェライト体を表面側基板及び裏面側基板のうち他方の基板に埋設するとともに、第2のフェライト体を表面側基板及び裏面側基板のうち

一方の基板に埋設して構成したものである。

【0018】このような構成により、基板の表面側及び裏面側にフェライト体を埋設したので、移動体通信機用のプリント基板上にフェライト効果を利用した更に小型化したヘリカルアンテナを得ることができる。

【0019】

【発明の実施の形態】次に、図面を用いて本発明における実施の形態について説明する。

【0020】図1は、本発明の第1の実施例における移動体通信機用アンテナを示す斜視図である。ここで、プリント基板10には、表面10aから裏面10bまで貫いた貫通スルーホール11、12、13、14、15、16が形成されている。また、基板の表面10a、及び裏面10bには、互いに平行な第1の仮想線Lと、第2の仮想線Mが描画されている。貫通スルーホール11、13、15は、第1の仮想線L上に位置しており、貫通スルーホール12、14、16は第2の仮想線M上に位置している。

【0021】また、貫通スルーホール11、13、15と貫通スルーホール12、14、16は、互い違いに向き合うように配置されている。そして、貫通スルーホール11と12の裏面側は、基板上で第1の直線状金属線状体17によって接続されている。

【0022】また、貫通スルーホール12と13の表面側は、基板上で第2の直線状金属線状体18によって接続されている。更に、貫通スルーホール13と14の裏面側は、基板上で第3の直線状金属線状体19によって接続されている。また、貫通スルーホール14と15の表面側は、基板上で第4の直線状金属線状体20によって接続されている。また、貫通スルーホール15と16の裏面側は、基板上で第5の直線状金属線状体21によって接続されている。

【0023】このように、各貫通スルーホール11～16が第1～第5の直線状金属線状体17～21によって、螺旋を描くように接続されて、ヘリカルアンテナ体を形成する。また、ヘリカルアンテナ体の一方の端部は、無線部接続部22に接続されている。

【0024】以上のような構成によって、移動体通信機用のプリント基板上に螺旋状のヘリカルアンテナを製作することができる。なお、以上の実施例では、貫通スルーホールの数が第1の仮想線L上の3個、第2の仮想線M上に3個づつ配設した例について説明したが、それ以上であっても同様の効果が得られる。

【0025】図2は、本発明の第2の実施例における移動体通信機用アンテナを示す斜視図である。本実施例において、プリント基板10の表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線Lおよび第2の仮想直線Mのうち、第1の仮想直線L上において表裏両面基板同士を貫通するよう基板10に3個以上の第1の貫通スルーホール11、13、15を形成するとと

もに、第2の仮想直線Mにおいて第1の貫通スルーホール11、13、15とは互い違いに向き合うように表裏両面基板を貫通するよう裏面基板に少なくとも3個の第2の貫通スルーホール12、14、16を形成しており、少なくとも3個の第1の貫通スルーホール11、13、15のうち、表裏両面基板の一側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と表裏両面基板の一側端部側の第2の貫通スルーホール12、14、16における表面側基板又は裏面側基板のうち一方の開口側と表面側基板又は裏面側基板のうち一方の基板上で第1の直線状金属線状体23により配線接続し、更に、表裏両面基板の一側端部側の第2の貫通スルーホール12、14、16における表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホール11、13、15のうち表裏両面基板の中央部側に位置する第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と表面側基板又は裏面側基板のうち他方の基板上で第1のループ状金属線状体24により山形に配線接続し、更に、表裏両面基板の中央部側に位置する第1の貫通スルーホール13における表面側基板又は裏面側基板のうち一方の開口側と第2の仮想直線上Mに形成した少なくとも3個の貫通スルーホール12、14、16のうち表裏両面基板の中央部側に位置する第2の貫通スルーホール14における表面側基板又は裏面側基板のうち一方の開口側と表面側基板又は裏面側基板のうち一方の基板上で第2の直線状金属線状体25により配線接続し、更に、表裏両面基板の中央部側に位置する第2の貫通スルーホール14における表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の他側端部側の第1の貫通スルーホール15における表面側基板又は裏面側基板のうち他方の基板の開口側と表面側基板又は裏面側基板のうち他方の基板上で第2のループ状金属線状体26により山形に配線接続し、更に、第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち、表裏両面基板の他側端部側の第1の貫通スルーホール15における表面側基板又は裏面側基板のうち他方の基板の開口側と第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の他側端部側の第2の貫通スルーホール16における表面側基板又は裏面側基板のうち他方の開口側と表面側基板又は裏面側基板のうち他方の基板上で第3の直線状金属線状体27により配線接続することによって、第1の仮想直線上における基板に形成した少なくとも3個の貫通スルーホール11、13、15及び第2の仮想直線上における基板に形成した少なくとも3個の貫通スルーホール12、14、16を前記表面側基板および裏面側基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成して構成したものである。

【0026】以上のような構成によって、移動体通信機用のプリント基板上に形成したヘリカルアンテナを円滑な螺旋形状に近づけることができる。

〔0027〕図3は、本発明の第3の実施例における移動体通信機用アンテナを示す斜視図である。ここで、プリント基板10上の貫通スルーホール11～16、第1、第2、第3の直線状金属線状体23、25、27及び第1、第2のループ状金属線状体24、26の構成は、第2の実施例と同様であるので説明を省略する。本実施例では、第1のループ状金属線状体24と第2のループ状金属線状体26及びプリント基板10との間にフェライト体28を配設したものである。

【0028】以上のように構成した本実施例では、フェライト体28をループ状金属線状体とプリント基板との間に配設したので、フェライト効果によってヘリカルアンテナの更なる小型化が図れる。

【0029】図4は、本発明の第4の実施例における移動体通信機用アンテナを示す斜視図である。本実施例において、プリント基板10の表面側で第1、第2のループ状金属線状体24、26の下にフェライト体28を埋設するための凹溝29を形成し、この凹溝29内にフェライト体を埋設したものである。

【0030】以上のように構成した場合には、フェライト体をプリント基板内に埋設したので、ヘリカルアンテナの更なる小型化が図れる。

【0031】図5は、本発明の第5の実施例における移動体通信機用アンテナを示す斜視図である。本実施例において、表裏両面基板上に仮想線として互いに平行に描画した第1の仮想直線Lおよび第2の仮想直線Mのうち、第1の仮想直線Lにおいて表裏両面基板同士を貫通するように基板に3個以上の第1の貫通スルーホール11、13、15を形成するとともに、第2の仮想直線上Mにおいて第1の貫通スルーホール11、13、15とは互い違いに向き合うように表裏両面基板を貫通するように両面基板に少なくとも3個の第2の貫通スルーホール12、14、16を形成しており、少なくとも3個の第1の貫通スルーホール11、13、15のうち、表裏両面基板の一側端部側の第1の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側と表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち一方の開口側とを表面側基板又は裏面側基板のうち一方の基板上で第1のループ状金属線状体30により山形に配線接続し、更に、表裏両面基板の一側端部側の第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第1の貫通スルーホール13における表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第2のループ状金属線状体31に

より山形に配線接続し、更に、表裏両面基板の中央部側に位置する第1の貫通スルーホール13における表面側基板又は裏面側基板のうち一方の開口側と第2の仮想直線上に形成した少なくとも3個の貫通スルーホールのうち表裏両面基板の中央部側に位置する第2の貫通スルーホール14における表面側基板又は裏面側基板のうち一方の開口側とを表面側基板又は裏面側基板のうち一方の基板上で第3のループ状金属線状体32により山形に配線接続し、更に、表裏両面基板の中央部側に位置する第2の貫通スルーホールにおける表面側基板又は裏面側基板のうち他方の開口側と第1の仮想直線上に少なくとも3個形成した貫通スルーホールのうち表裏両面基板の他側端部側の第1の貫通スルーホール15における表面側基板又は裏面側基板のうち他方の基板の開口側と表面側基板又は裏面側基板のうち他方の基板上で第4のループ状金属線状体33により山形に配線接続し、更に、第1の仮想直線上に少なくとも3個形成した第1の貫通スルーホールのうち、表裏両面基板の他側端部側の第1の貫通スルーホール15における表面側基板又は裏面側基板のうち他方の基板の開口側と第2の仮想直線上に少なくとも3個形成した表裏両面基板の他側端部側の第2の貫通スルーホール16における表面側基板又は裏面側基板のうち他方の開口側とを表面側基板又は裏面側基板のうち他方の基板上で第5のループ状金属線状体34により山形に配線接続することによって、第1の仮想直線上における基板に少なくとも3個形成した第1の貫通スルーホール11、13、15及び第2の仮想直線上における基板に少なくとも3個形成した第2の貫通スルーホール12、14、16を表面側基板および裏面基板に互い違いの螺旋状に接続しヘリカルアンテナ体を形成したものである。

【0032】以上のように構成した場合、各貫通スルーホール11～16をそれぞれのループ状金属線状体30～34で接続したので、円滑な螺旋形状のヘリカルアンテナをプリント基板上に製造することができる。

【0033】図6は、本発明の第6の実施例における移動体通信機用アンテナを示す斜視図である。本実施例において、第1のループ状金属線状体30と第3のループ状金属状体32及び、基板表面10aとの間に第1のフェライト体35を配設するとともに、第2のループ状金属線状体31と第4のループ状金属状体33及び、基板裏面10bとの間に第2のフェライト体36を配設して構成したものである。

【0034】以上のように構成した場合、各貫通スルーホール11～16をそれぞれのループ状金属線状体30～34で接続したので、円滑な螺旋形状とできると共に、フェライト効果により、ヘリカルアンテナの小型化が図れる。

【0035】図7は、本発明の第7の実施例における移動体通信機用アンテナを示す斜視図である。本実施例に

において、第1のフェライト体35を基板の表面10aに凹溝37を形成して埋設するとともに、第2のフェライト体36を基板の裏面10bに凹溝38を形成して埋設して構成したものである。

【0036】以上のように構成した場合、フェライト体をプリント基板の表面及び裏面に配設すると共に、基板に埋設したのでフェライト効果によりヘリカルアンテナの更なる小型化が達成できる。

【0037】図8は、本発明の第8の実施例における移動体通信機用ダイバーシチアンテナを示す構成図である。ここでは、第1のヘリカルアンテナ39と第2のヘリカルアンテナ40を互いに直交するように配置し、この2個のヘリカルアンテナを高周波切換えスイッチ41で切換え可能に無線部接続部42と接続している。

【0038】以上のように構成した場合、移動体通信機の到達する電波が偏波したときでも、高周波切換えスイッチ41を切換えることにより良好に受信できる移動体通信機用ダイバーシチアンテナを提供することができる。

【0039】図9は、本発明の第9の実施例における移動体通信機用ダイバーシチアンテナを示す構成図である。本実施例において、第1のヘリカルアンテナ43と第2のヘリカルアンテナ44とは互いに直交するように配置されると共に、夫々1/4波長(λ)の伝送線路45、46を介して無線部接続部47に接続されている。また、第1、第2のヘリカルアンテナと1/4波長の伝送線路45、46との間に、高周波ON/OFFスイッチ48、49を接続する。この高周波ON/OFFスイッチ48、49は、どちらか一方をONにした場合、他方がOFFとなるように連動する構成となっている。

【0040】以上のように構成した移動体通信機用ダイバーシチアンテナの場合、第8の実施例のように高周波切換えスイッチを使用する事なく、移動体通信機の偏波に影響を受けずに良好な受信が可能である。

【0041】図10は、本発明の第10の実施例における移動体通信機用ダイバーシチアンテナを示す構成図である。本実施例において、無指向性アンテナ50と指向性アンテナ51を高周波切換えスイッチ52で切換え可能に無線部接続部53に接続している。

【0042】以上のように構成した場合、移動体通信機が受信電波の弱い場所にあるときには、指向性アンテナ51を使用して利得を上げることができる。また、電波状態の良好場所においては、無指向性アンテナ50に切換えて使用することができる。

【0043】図11は、本発明の第11の実施例における移動体通信機用ダイバーシチアンテナを示す斜視図である。本実施例において、プリント基板54上に指向性アンテナ55が形成されており、基板上の指向性アンテナ55と無指向性アンテナ50とを高周波切換えスイッチ52で切換え可能に無線部接続部53に接続してい

る。

【0044】以上のように構成した場合、移動体通信機が受信電波の弱い場所にあるときには、指向性アンテナ55を使用して利得を上げることができる。また、プリント基板上に指向性アンテナを形成したので装置の小型化が達成できる。

【0045】図12は、本発明の第12の実施例における移動体通信機用ダイバーシチアンテナを示す斜視図である。本実施例において、互いに指向性方向を異にした

10 第1、第2の指向性アンテナ56、57をプリント基板上に形成し、高周波切換えスイッチ58で切換え可能に接続した指向性アンテナ群59と無指向性アンテナ50とを高周波切換えスイッチ52で切換え可能に無線部接続部53に接続している。

【0046】以上のように構成した場合、移動体通信機の受信電波が弱いときにも、指向性アンテナ群59に切り換えて使用できると共に、複数の指向性アンテナの中から指向方向を選択して高い利得のアンテナを使用することができます。したがって、電波の弱い場所でも、利得を上げることができる。

【0047】

【発明の効果】本発明によれば、プリント基板上に貫通スルーホールを互い違いに平行に形成し、これらの貫通スルーホールの端部を全体が螺旋を描く様に接続してヘリカルアンテナを構成したので、小型の移動体通信機用アンテナを得ることができます。

【図面の簡単な説明】

【図1】本発明の第1の実施例における移動体通信機用アンテナを示す斜視図

30 【図2】本発明の第2の実施例における移動体通信機用アンテナを示す斜視図

【図3】本発明の第3の実施例における移動体通信機用アンテナを示す斜視図

【図4】本発明の第4の実施例における移動体通信機用アンテナを示す斜視図

【図5】本発明の第5の実施例における移動体通信機用アンテナを示す斜視図

【図6】本発明の第6の実施例における移動体通信機用アンテナを示す斜視図

40 【図7】本発明の第7の実施例における移動体通信機用アンテナを示す斜視図

【図8】本発明の第8の実施例における移動体通信機用ダイバーシチアンテナを示す構成図

【図9】本発明の第9の実施例における移動体通信機用ダイバーシチアンテナを示す構成図

【図10】本発明の第10の実施例における移動体通信機用ダイバーシチアンテナを示す構成図

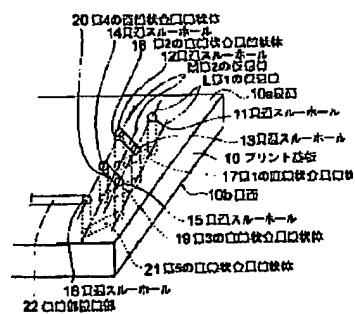
【図11】本発明の第11の実施例における移動体通信機用ダイバーシチアンテナを示す斜視図

50 【図12】本発明の第12の実施例における移動体通信

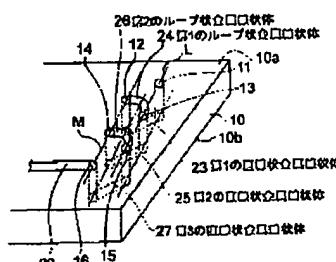
15	
機用ダイバーシチアンテナを示す斜視図	* 3 2
【図13】従来の移動体通信機用ヘリカルアンテナを示す構成図	3 3
【符号の説明】	3 4
L 第1の仮想線	3 5
M 第2の仮想線	3 6
10 プリント基板	3 7, 3 8
10a 表面	3 9
10b 裏面	4 0
11~16 貫通スルーホール	4 1
17 第1の直線状金属線状体	4 2
18 第2の直線状金属線状体	4 3
19 第3の直線状金属線状体	4 4
20 第4の直線状金属線状体	4 5, 4 6
21 第5の直線状金属線状体	4 7
22 無線部接続部	4 8, 4 9
23 第1の直線状金属線状体	5 0
24 第1のループ状金属線状体	5 1
25 第2の直線状金属線状体	5 2
26 第2のループ状金属線状体	5 3
27 第3の直線状金属線状体	5 4
28 フェライト体	5 5
29 凹溝	5 6
30 第1のループ状金属線状体	5 7
31 第2のループ状金属線状体	5 8
	*
	5 9

第3のループ状金属線状体
第4のループ状金属線状体
第5のループ状金属線状体
第1のフェライト体
第2のフェライト体
凹溝
第1のヘリカルアンテナ
第2のヘリカルアンテナ
高周波切換えスイッチ
無線部接続部
第1のヘリカルアンテナ
第2のヘリカルアンテナ
伝送線路
無線部接続部
高周波ON/OFFスイッチ
無指向性アンテナ
指向性アンテナ
高周波切換えスイッチ
無線部接続部
プリント基板
指向性アンテナ
第1の指向性アンテナ
第2の指向性アンテナ
高周波切換えスイッチ
指向性アンテナ群

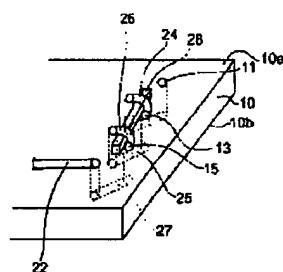
【図1】



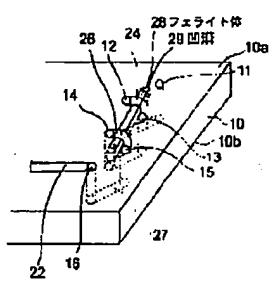
【図2】



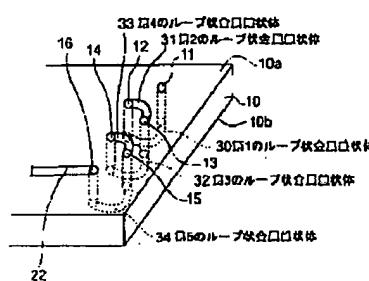
【図3】



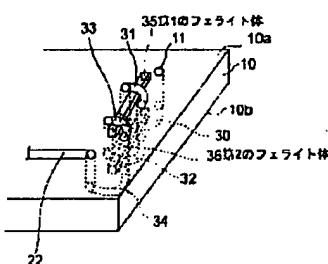
【図4】



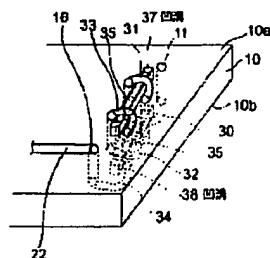
【図5】



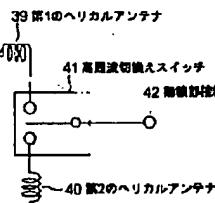
【図6】



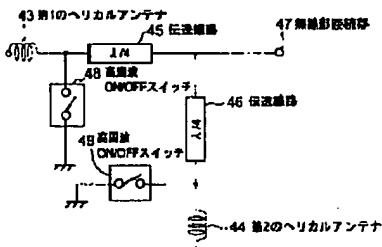
【図7】



【図8】



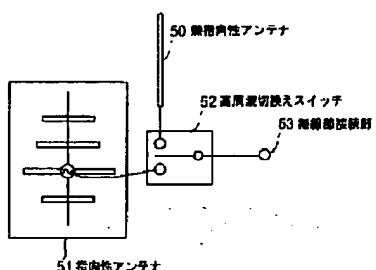
【図9】



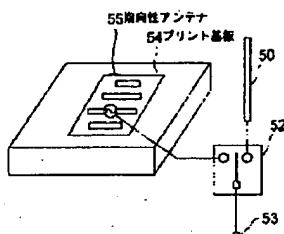
【図13】



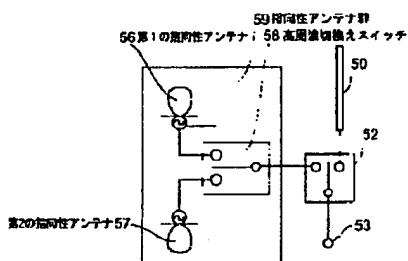
【図10】



【図11】



【図12】



フロントページの続き

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